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(54) **Surgical Instruments and procedures for stabilizing the beating heart during coronary artery bypass graft surgery**

(57) The invention is methods and devices which a surgeon may use to stabilize the beating heart during a surgical procedure on the heart. Pursuant to the invention, a stabilizing device is introduced through an opening in the chest and brought into contact with the beating heart. By contacting the heart with the device and by exerting a stabilizing force on the device, the motion of the heart caused by the contraction of the heart muscles is effectively eliminated such that the heart is stabilized and the site of the surgery moves only

minimally if at all. Typically, in separate steps, the surgeon contacts the heart with the stabilizing means, assesses the degree of movement of the anastomosis site, and exerts a force on the stabilizing means such that the contraction of the beating heart causes only minimal excess motion at the surgery site. By fixing the position of the stabilizing means in a configuration where the motion of the beating heart is effectively eliminated, the surgeon is able to stabilize the beating heart for the duration of the procedure. The stabilizing means

may be attached to a rigid support or may be attached to a semi-rigid support which is rendered motionless mechanically, chemically, or by human intervention. In certain preferred embodiments, the stabilizing means is affixed to a semi-rigid support which is caused to become rigid, by any of a variety of techniques, such that the position of the stabilizing means becomes fixed by the support, and the heart remains substantially motionless for the duration of the procedure.

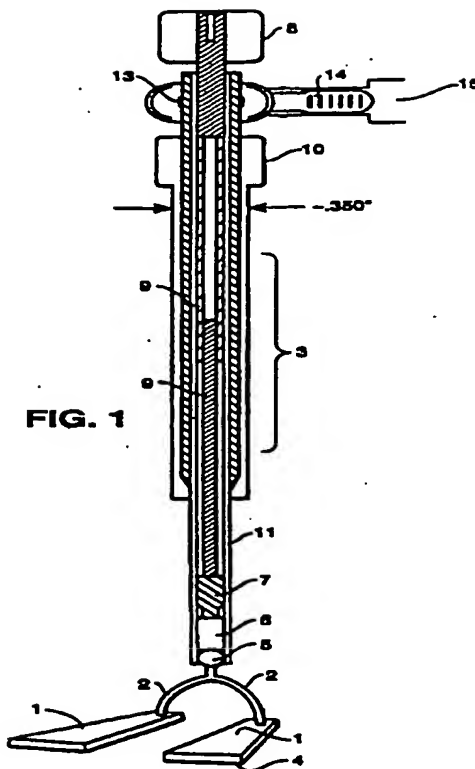


FIG. 1



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EUROPEAN SEARCH REPORT

Application Number
EP 97 10 2789

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	WO 94 14383 A (LASER ENG INC) 7 July 1994 * the whole document *	1	A61B17/02 A61B19/00
E	WO 97 10753 A (MEDTRONIC INC ;BORST CORNELIUS (NL); MANSVELT BECK HENDRICUS J (NL) 27 March 1997 * the whole document *	1	
A	WO 95 15715 A (STANFORD SURGICAL TECHNOLOGIES) 15 June 1995 * abstract; figure 2 * * page 28, line 1 - page 29, line 4; figure 15 *	1	
A	US 4 726 356 A (SANTILLI ALBERT E ET AL) 23 February 1988 * abstract; figure 1 *	1	
A	US 5 167 223 A (KOROS TIBOR ET AL) 1 December 1992 * column 6, line 55 - column 7, line 24; figure 1 *	1	
A	US 4 637 377 A (LOOP FLOYD D) 20 January 1987 * abstract; figure 2 *	1,175	TECHNICAL FIELDS SEARCHED (Int.Cl.6) A61B A61L A61F
A	US 4 973 300 A (WRIGHT JOHN T M) 27 November 1990 * column 1, line 5 - column 2, line 48; figure 1 *	175	
A	EP 0 630 629 A (NDM ACQUISITION CORP) 28 December 1994 * abstract; figure 2B *	175	
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 9 September 1997	Examiner Jameson, P
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons * : member of the same patent family, corresponding document	

EPO FORM 1503 (12/92) (Pec/Ch)



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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claims:
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

X LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims 1-44, 46-174. Means for stabilizing the beating heart comprising a contact 177-186, 188: member shaped to engage the surface of the heart.
2. Claim 45: A conical cannula.
3. Claims 175, 176, 187, 189: Means for positioning the heart comprising a flat flexible sheet.

- ☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☒ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respects of which search fees have been paid, namely claims 1-44, 46-189
- ☐ None of the further search fees has been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims